Inventory & Monitoring
Pacific Island Network

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Plants Issue

The Natives Are Priceless

National Park Service
U.S. Department of the Interior

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The National Park Service (NPS) has implemented natural resource inventory and monitoring on a servicewide basis to ensure all park units possess the resource information needed for effective, science-based management, decision-making, and resource protection.

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***NOTE:** Unless indicated all photos and articles are NPS.

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Outreach and Staffing Update

Program Review

In July the Pacific Island Network (PACN) Inventory and Monitoring (I&M) program had its start-up review. A review team composed of national and regional NPS scientists asked the basic question "Is the network set up to succeed?" The two-and-a-half day process involved detailed I&M presentations on data management, science communications, monitoring, and inventories, in addition to much discussion among participants and NPS staff involved with the PACN.

A subsequent report listed recommendations made by the panel that PACN immediately started to implement. Monitoring progress for each Vital Sign was evaluated in the context of initial priorities set a few years ago with broad park input. This emphasis on priorities resulted in the recommendation that work be halted on some low-priority protocols that were not going to be implemented with I&M funds. The marine and freshwater systems protocols were viewed to be in excellent shape as was the data management program. Specific comments were made about other protocols and the science communication program. The review team also recommended an emphasis on reporting results as part of the core duties of I&M. The PACN thanks all the participants in the review and looks forward to implementing recommendations that will help us succeed in our mission.

Outreach

I&M participated in the PUHE cultural festival and the Maui County Fair.

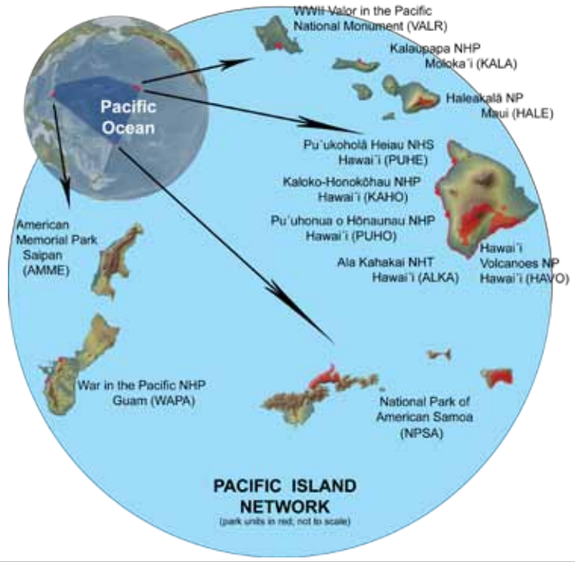
Jane Hawkey and Tim Carruthers from the University of Maryland Center for Environmental Studies, and Mike Whatley from the national NPS office joined PACN staff to conduct science communications products scoping meetings with staff at KAHO, KALA, and HAVO. The resulting products will include fliers and posters for park visitors and a condition assessment for KAHO (long term).

Staffing Update

NPS: Plant Biotechs Julie Christian and Corie Yanger started at HAVO on September 14 (read their bios on the next page).

Wildlife Ecologist and former Program Coordinator, Leslie HaySmith, has decided to leave the NPS for other adventures. Leslie's contributions to the development of the Pacific Island Network I&M Program have been many. She has largely developed the program from the ground up during her five-year tenure. We wish her the best in her future endeavors and a warm mahalo for all of her hard work through the years.

COOPERATORS: We also bid adieu to Mariska Weijerman who has devoted the last several years of her professional life to the marine and aquatic realms in West Hawai'i parks and to the PACN anchialine pools monitoring protocol. It has been a pleasure working with her.



Featured Staff - Plant Biotechs

Corie Yanger was born in Hawaii, although her formative years were spent in Madison, Wisconsin, where she graduated with a B.S. in Biological Aspects of Conservation in 2006. It was through her undergraduate experience that she reconnected with Hawaii, spending the summer of 2003 and a year, 2004 to 2005, as a field assistant/intern. During that time, Corie developed a passion for plants while learning about long-term vegetation monitoring techniques and paleoecology at Haleakalā National Park, Maui.

From 2007 to 2009, she worked as a technician for the Hawai'i Volcanoes National Park Restoration Ecology Program in the Natural Resources Management Division. Corie kept busy as a technician, functioning as both volunteer facilitator and field monitoring leader for the Restoration Program. She is excited to be working for the Inventory & Monitoring Program and is looking forward to learning more about conservation and management issues at other Pacific West Region Parks, as well as meeting new people and plants.

Julie Christian just arrived on the Big Island after finishing her MSc. in Botany at the University of Wisconsin-Madison. For her thesis work, Julie documented the response of native shrubs to the removal of non-native cattle on Santa Rosa Island in Channel Islands National Park (CHIS). This research provided Julie a unique opportunity to return to CHIS where in 2001 she was a Student Conservation Association intern; first with interpretation and then the I&M vegetation program. After sixteen months at CHIS, Julie stayed on the coast of California to work at Santa Monica Mountains National Recreation Area (SAMO) where she led the vegetation community classification and mapping effort and participated in native ecosystem restoration. As a technician for the Mediterranean Coast Network in 2005, Julie divided her time between the neighboring parks, monitoring fire effects at SAMO and studying rare plants at CHIS. During her six years in California, Julie developed a love of outrigger canoeing. Over the past three years in her native Wisconsin, she raced canoes throughout the Midwest and rekindled her love of winter. While she will miss the snow, Julie is excited to be back on the Pacific.

Calendar and Monitoring Updates

Calendar

Oct. 3-5	I&M participates in Maui Co. Fair with HALE staff
Oct. 5	Annual Administrative Report due to Regional Coordinator
early Nov.	Steering committee meeting
Dec. 15-17	Pacific Island Network Board of Directors meeting in Honolulu

Monitoring Updates

Sept. 6-27	The aquatic and marine protocols group traveled to NPSA to conduct stream animals and water quality sampling on NPSA's three islands. In addition, scoping was conducted for the fish harvest protocol.
Oct. 19-23	Vegetation mapping field data collection in HAVO
Oct. 19-23	Water quality sampling in HALE
Oct. 26-30	Anchialine pools pilot study in HAVO
November	Vegetation mapping accuracy assessment field work in Kona park units
Nov. 2-6	Water quality sampling in WAPA and AMME
Nov. 2-10	Benthic marine and marine fish sampling in KAHO
Nov. 23-25	Water quality sampling at PUHE, PUHO, and ALKA
December	Water quality sampling in KALA and NPSA
Dec. 1-13	Vegetation mapping field leader and botanist travel to NPSA to train staff field on data collection procedures

Mapping Plants at PUHE

18 official new species for site

What plants can you expect to see when you visit Pu'ukoholā Heiau National Historic Site (PUHE)? Lots and lots of milo. In a mapping and inventory report of vascular plants at the historic site, in 2001 Mashuri Waite recorded 113 individual milo (*Thespesia populnea*) trees and saplings. Placing a far second to fifth place were kī (*Cordyline fruticosa*), kou (*Cordia subcordata*), coconut (*Cocos nucifera*), and hala (*Pandanus tectorius*) with between 40 and 59 individuals of each species.

The emphasis of the inventory was to record the positions of species planted by park staff, however, some naturally occurring species such as *Jacquemontia ovalifolia sandwicensis* were also noted. A total of 458 GPS positions were taken of 37 plant species. The majority of species found were planted around office buildings by park staff. Eighty-one voucher specimens were collected for 73 species—including 18 new species not on the NPSpecies checklist for PUHE, and species that had no vouchers in collections.

Waite was able to identify two flowering plants which were unidentifiable in previous surveys; they were *Mollugo cerviana* and *Wikstroemia pulcherrima*. Four invasive species and four plants with no historical context were recommended for immediate removal including Chinese banyan (*Ficus microcarpa*), marungai (*Moringa oleifera*), chili pepper (*Capsicum frutescens*), and Madagascar olive (*Noronhia emarginata*). With the recent completion of the visitor center, there are undoubtedly more plants to add to this checklist. Still, this inventory stands as a baseline for monitoring changes in the plant community found at PUHE.

The native and Polynesian-introduced plant species thriving at PUHE continue to provide visitors with a natural counterpart to the outstanding cultural aspects of this historic site.

Top to bottom: 'ākulikuli (*Sesuvium portulacastrum*), milo flower (*Thespesia populnea*), and kīpūkai (*Heliotropium curassavicum*)

—S. Nash

Museums - you may see'um

National park museums join the digital age

Have you ever wanted to explore the art of the Nez Perce or the stories and artifacts of "The Rock" (Alcatraz prison), but feel like you're stuck on a distant island in the Pacific? Well, how about a virtual museum tour? The Museum Management Program (MMP) provides a virtual exhibit of many parks' collections open to the general public for viewing. You can explore the house, artifacts, and portraits of Frederick Douglass' life. Or, you could choose to view the artwork and museum collections of Everglades National Park or learn about the gruesome medical techniques of the Revolutionary War as described by the Guilford Courthouse National Military Park. Images, narratives, sound clips, and even lesson plans are available in these exhibits. Additionally, there is a park museum collection profile for each park which provides a narrative, the collection size, and description of the facilities.

For more general research of museum collections, check out the NPS museum collections on the Web Catalog (www.museum.nps.gov/). The PACN is already represented by two parks: American Memorial Park and War in the Pacific National Historical Park. Through this catalog you can search through either the cultural resources or natural history databases, which encompass the disciplines of ethnology, archeology, history, biology, paleontology, and geology. In the cultural resources database you can search by discipline, eminent figure (e.g., Abraham Lincoln), artist, manufacture date, or catalog number. For the natural history database, searching possibilities include discipline, scientific name, common name, collection date, collector, or catalog number. Many items include an image as well as metadata.

The museum management team encourages parks to submit images and/or metadata of artifacts and specimens for inclusion in the Web Catalog museum collections. The website is set up for 360 parks, yet currently contains collections from only 27 units. In a recent meeting with digital image managers, Joan Bacharach, the museum curator at the NPS Washington Office, emphasized the need for park resource managers to send items to the catalog to represent the museum resources at each park unit.

How do you submit images for inclusion in the Web Catalog? Contact Joan Bacharach (Joan_Bacharach@nps.gov) with your request. In the meantime, browse your unit's collection of artifacts and specimens. If your specimens do not have images, consult the Publications section of the MMP website where you can find the Museum Handbook. Part II of the handbook has detailed instructions on how to take high-quality photographs of your specimens. Also included in the Publications section are Conserve O Grams—a technical leaflet series—which provide a wealth of knowledge on storing and preserving museum specimens and digital media.

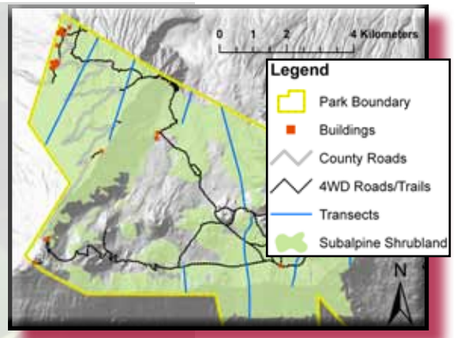
Museum Management Program website:
http://www.nps.gov/history/museum/

—S. Nash

Established Invasive Plants Monitoring

Network Parks Where Invasive Plants To Be Monitored

- American Memorial Park (AMME)
- Kalaupapa NHP (KALA)
- Kaloko-Honokōhau NHP (KAHO)
- Hawai'i Volcanoes NP (HAVO)
- Haleakalā NP (HALE)
- National Park of American Samoa (NPSA)
- Pu'uhonua o Hōnaunau NHP (PUHO)
- Pu'ukoholā Heiau NHS (PUHE)



Invasives are monitored along plant community transects, trails, and roads at HALE.

Importance: Threat to Native Flora and Fauna

Nonnative plant species invasions present a serious threat to Pacific island ecosystems. Invasion by nonnative plants reduces native plant diversity and abundance, and alters vegetation structure. At their very worst, ecologically disruptive species (e.g., nonnative grasses, tamaligi, miconia, strawberry guava) are able to completely displace the native vegetation and alter ecosystem processes. Nonnative plant invasions can also lead to significant economic and cultural costs. For example, nonnative grasses are responsible for increased fire frequency and spread in wildland urban interfaces, and the loss or alteration of culturally significant species and landscapes.

Among the more than 4,600 nonnative species established in the Hawaiian Islands, there are 100+ highly disruptive nonnative pest species. These are species are regarded as the greatest invasive plant threats to native Hawaiian biota and ecosystems. There are over 105 species identified as disruptive or potentially disruptive in American Samoa; and 133 species identified in Micronesia. Some of these species have not invaded parks, while others are just beginning to establish; still others have well-established populations that have already displaced native plant communities.

Some major invasive plants in PACN parks from top: strawberry guava (*Psidium cattleianum*), tamaligi (*Falcataria moluccana*), scarlet gourd (*Coccinia grandis*), fountain grass (*Pennisetum setaceum*), and miconia (*Miconia calvescens*)

Long-Term Monitoring

Long-term monitoring of invasive plant species is critical for the effective management of native ecosystems. The current protocol takes a two pronged approach to monitoring invasive plants every five years within PACN parks. Established invasive species will be identified and counted along both fixed and random belt transects within relatively intact natural areas or focal plant communities. These data will allow managers to generate maps of weed distributions and detect changes in established weed populations. In addition, a select set of man-made corridors including roads, trails, fence lines, and other disturbed areas will be surveyed for highly disruptive invasive plants because these are areas where seeds are often transported by people (e.g., seeds on vehicles, boots, field equipment, etc.). Combined, these two techniques aim to monitor established invasive plant species as well as incipient invaders. Effective management of park natural areas cannot occur without a comprehensive, quantitative, long-term monitoring program.

Monitoring Objective

Determine the changes in the distribution and abundance of disruptive nonnative plant species:
(1) along belt transects throughout focal plant communities, and
(2) within and around major dispersal corridors (roads, trails, building sites, etc...)

Management Applications

- Provide nonnative species abundance and distribution information allowing managers to assess changing ecosystem threats, formulate control strategies (e.g., eradication, containment, exclusion, monitoring) and prioritize areas and species for management.
- Reduce or prevent widespread invasions of incipient or new species before control becomes difficult.
- Evaluate the effectiveness of management actions such as herbicide treatments, biological controls, ungulate removal, and fencing.

For more information contact I&M Botanist Alison Ainsworth: alison_ainsworth@nps.gov

Network website: http://science.nature.nps.gov/im/units/pacn/
Resource website: http://science.nature.nps.gov/im/units/pacn/monitoring/vs_invasive_plants_status.cfm

Pu'ukoholā Heiau National Historic Site

History: On a barren hill in Hawaii Island's Kohala district, the powerful chief Kamehameha consecrated a massive temple of war in the summer of 1791. Pu'ukoholā Heiau, which he dedicated to his family war god Kūkā'ilimoku, was viewed by Kamehameha and his enemies as the conduit through which he would increase his mana (spiritual power) to do what no one had ever done in the history of the Hawaiian people. From this temple on Hawai'i Island, Kamehameha began in earnest his struggle to unify all of the Hawaiian Islands under his authority. During this time Kamehameha greatly benefited from the westerners that had begun visiting and trading in the islands. In addition to acquiring new technologies, such as cannons, muskets and western-style ships, Kamehameha relied on the assistance of foreign advisors in his struggle against rival chiefs. Most notably, two British sailors, John Young and Isaac Davis, served as loyal advisors to Kamehameha and were given great authority in his kingdom.

Pu'ukoholā Heiau National Historic Site (PUHE) was officially established on August 17, 1972 to restore and preserve "the historically significant temple associated with Kamehameha the Great, who founded the historic Kingdom of Hawaii, and the property of John Young who fought for Kamehameha the Great."

The two main Heiau in the late 1800's (above) and in 2009 (below).

Cultural Resources: The namesake of the park, Pu'ukoholā Heiau, dominates the historic scene. It is believed by many that this temple was actually built upon an existing older temple, parts of which were incorporated into the current structure by Kamehameha in the early 1790's. Another primary site is the John Young Homestead, consisting of the remains of several habitations and related structures. Archeological research indicates that the main structure, believed to have been the home of John Young, is the oldest known western-style house in the Hawaiian Islands. The primary house appears to be a transitional structure, combining both Hawaiian and European styles.

Directly below Pu'ukoholā Heiau is an older temple called Mailekini Heiau. Believed to have been used by the ancestors of Kamehameha, this structure was converted into a fort by John Young at the request of Kamehameha sometime after 1810. Although no weapons remain, this fort is believed to have been armed with as many as 21 canons and possessed a storehouse for European firearms.

Just offshore is Hale o Kapuni Heiau, a now-submerged temple that was once dedicated to ancestral spirits who visited the site in the form of sharks. In addition to historic structures, the park is home to Pelekane, a royal courtyard that is believed to have been a home for Kamehameha and his family, the birthplace of Queen Emma and the landing site of important foreign visitors who came here between 1790 and the mid 1800's.

The presumed birthplace of Queen Emma.

Natural Resources: Situated in the driest region of the Hawaiian Islands, PUHE receives very little precipitation. Kawaihae, where PUHE is located, holds the state record for the lowest annual precipitation at 0.19 feet. Because of the desert climate, the diversity of flora and fauna is severely limited. Although many plant species within the park have been introduced since European contact, some trees such as the kukui (*Aleurites moluccana*) date back to early Polynesian settlement.

Ma'o (*Gossypium sandvicense*) may have dotted the landscape in King Kamehameha's time just as it does today.

Native flora can also be found in this tropical desert, including pili grass (*Heteropogon contours*), milo (*Thespesia populnea*), and 'ilima (*Sida fallax*). The only endemic terrestrial mammal in the islands, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), is occasionally seen in PUHE. Bird life in the park is usually limited to introduced species, however migratory shore birds

and the Hawaiian owl (*Asio flammeus sandwicensis*) can occasionally be seen. Arguably the most popular natural resource commonly observed by the park's visitors is the black-tipped reef sharks (*Carcharhinus melanopterus*) that frequent Pelekane Bay. Additionally, green sea turtles (*Chelonia mydas nydas)*, spinner dolphins (*Stenella longirostris*), and humpback whales (*Megaptera novaeangliae*) are common adjacent to the park's authorized boundary.

During the past year and a half, volunteers have been monitoring the black-tipped reef shark population in Pelekane Bay. More extensive research is to be conducted through mid-2010 through a cooperative agreement with the Hawaii Marine Mammal Consortium. For many years, during the winter months, the Hawaiian Islands Humpback Whale National Marine Sanctuary includes PUHE in the "Sanctuary Ocean Count," which provides important population and distribution information on humpback whales in the islands.

The Pacific Island Network has conducted several inventories at PUHE including: a reptile and amphibian survey, a hoary bat survey, a plant survey, and a shoreline bird survey. Water quality monitoring is currently occurring in the park, and climate, freshwater animals, and various plant monitoring programs are forthcoming. In addtion, a draft vegetation map has just been completed for the site.

Current Issues in Management:

The most pressing issue for PUHE is the stabilization and repair work currently underway as a result of the 2006 earthquakes, which severely damaged historic structures. A dedicated team of NPS employees and volunteers have been repairing the walls of Pu'ukohola Heiau and Mailekini Heiau, and in September began work on the John Young Homestead.

Furthermore, there is the potential that the State of Hawaii will reroute Highway 270 around the park, thus making PUHE a contiguous unit and allowing safe access for visitors to the John Young Homestead.

The house gecko (*Hemidactylus frenatus*) was the most abundant of four species of reptiles found during a herpetological survey. The green sea turtle (*chelonia mydas mydas*) was the only native reptile documented in the park.

Finally, as a result of the American Recovery and Reinvestment Act of 2009, $2.7 million was secured to mitigate sedimentation issues in the watershed and Pelekane Bay. This grant is administered by the National Oceanic and Atmospheric Administration, and will seek to restore nearly 1,500 acres of coastal and marine habitat by reducing the amount of land-based sediment on coral reefs and the nearshore environment.

Come visit us in person or on-line at: www.nps.gov/puhe/index.htm

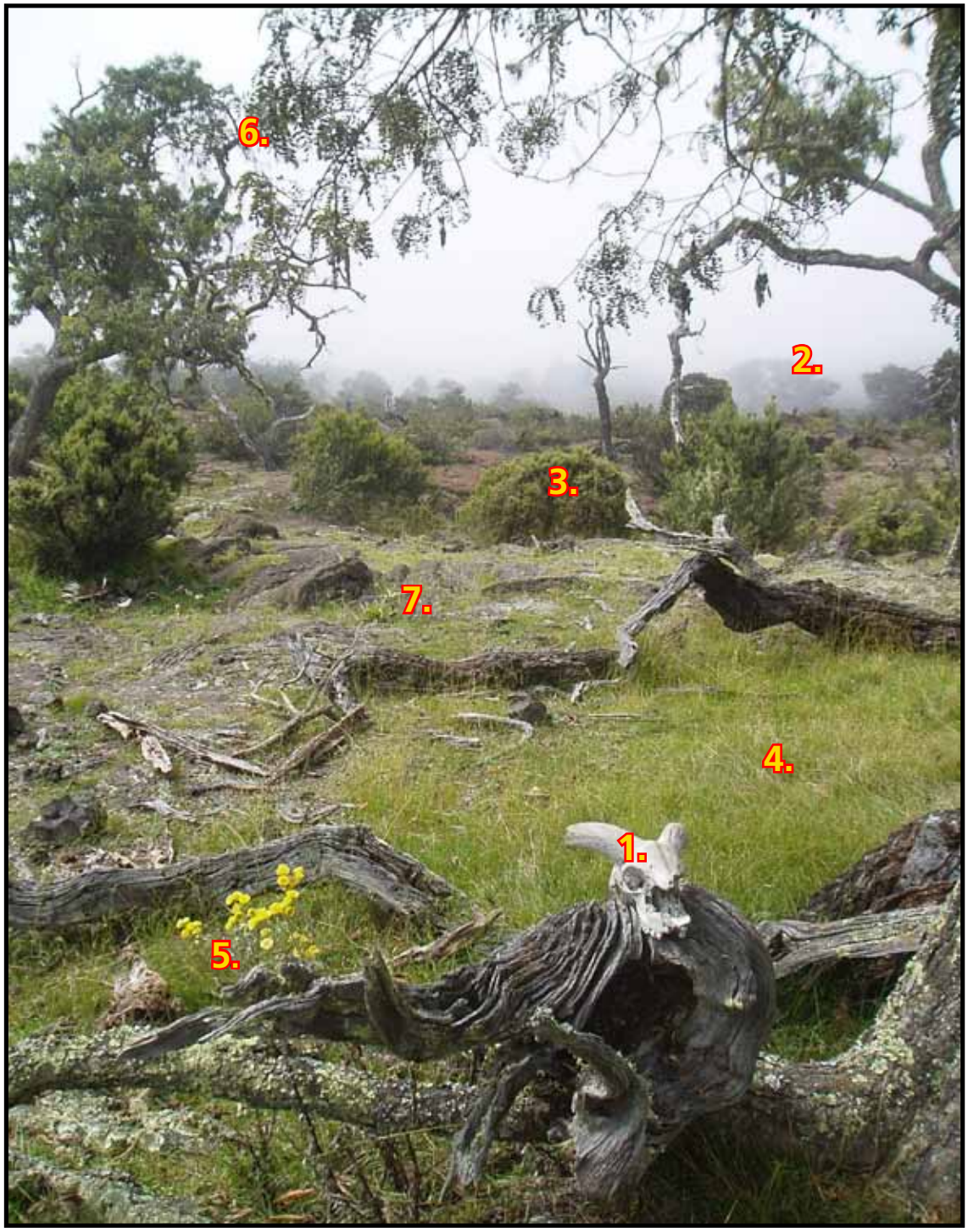
—G. Cunningham, Ranger

Pelekane stream has endured harsh changes over the years. Planned improvements to the watershed should partially restore the health of the stream and bay.

Archived photo of Kawaihae shoreline (left) and photo from 2009. Although kiawe (*Prosopis pallida*) are now common nonnative trees on the Kohala coast, the tree on the left would likely have been one of the pioneers on the Big Island. The kiawe on the right may be one of its descendants which must now share space with cars and a harbor wall.

The Conquerors

Humankind's influence touches everything in nature. While large scale or worldwide influences such as global climate change can be difficult to perceive, our footprints on local native ecosystems are often glaringly obvious to the astute observer. Since people arrived in the Pacific islands, we have been altering the landscape to suit our needs including the introduction of domesticated and game animals, and agricultural, medicinal, and ornamental plants. We have also unintentionally introduced many species (wasps, mosquitoes, rats, and many others). Some of these introductions appear to have had minimal impact on the flora and fauna that pre-date them (e.g., ti, plumeria). Other nonnative species outcompete or prey on native species and have dramatically altered the native environment (e.g., strawberry guava, mongoose, brown tree snake, avian malaria, northern cardinal).



Have you ever looked out your window or at the side of the road and thought about which species of plants and animals are native to your island and which are nonnative?

The photo on the left is from Kahuku (HAVO) on the south side of the island of Hawai'i. Is this a healthy native Hawaiian landscape? What is native and what is introduced?

For answers visit: http://science.nature.nps.gov/im/units/pacn/outreach.cfm

Definition of terms

Native species = species that occur naturally in a geographical area

Nonnative species = species that do not naturally occur in a geographical area and which could not have arrived without the influence of humans

Invasive species = nonnative species which aggressively compete for resources with or directly depredate native species

—C. Nash & A. Ainsworth